**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**
**BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

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| In re application of: | Gregory S. GLENN | : | Confirmation No.: 8302 |
| Application No.: | 10/677,191 | : | Group Art Unit: 1753 |
| Filed: | October 2, 2003 | : | Examiner: Thanh-Truc TRINH |

For: SOLAR CELL STRUCTURE WITH INTEGRATED DISCRETE BY-PASS DIODE

# REPLY BRIEF

**MAIL STOP APPEAL BRIEF-PATENTS**
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Appellant files this Reply Brief in response to the Examiner's Answer. This Reply Brief is due no later than May 19, 2008, as May 18, 2008 is a Sunday in the District of Columbia. The Examiner's Answer was mailed on March 19, 2008.

After reviewing the Examiner's Answer, and in order to more clearly narrow the issues for review by the Board, Appellant believes that there are two outstanding issues on which Appellant and the Examiner cannot agree.

1. (a) Whether the Examiner is correct in maintaining that Glenn (U.S. Patent No. 6,313,396) teaches a substrate that is a heat sink (as claimed by Appellant in each of independent claims 1, 11 and 16) or whether the Applicant is correct in maintaining that Glenn does not teach a heat sink, but rather a substrate that is a dielectric or an insulator, and (b) whether the non-conductive reinforcing tape of Hartman (U.S. Patent No. 4,577,051) constitutes a heat sink.

2. Whether the references relied on by the Examiner teach a joint between the intermediate structure and the heat sink, wherein the joint comprises a metallic trace deposited on a dielectric layer, as claimed by the Applicant in claims 9, 14 and 19.

Appellant submits that if the Board agrees with the Appellant in its position on issue 1 above, then all the claims of the application are allowable and the Board does not have to address issue 2. If the Board agrees with the Appellant in its position on issue 2, then claims 9, 14 and 19 are separately allowable without reference to the Board's decision on issue 1.

Issue 1. Does the cited prior art teach a heat sink?

(a) The Examiner relies on Glenn (U.S. Patent No. 6,313,396) as teaching a heat sink, one of the elements of Applicant's claims. In the grounds of rejection, the Examiner has identified element 20 of Glenn as a heat sink. Although the Examiner has characterized Appellant's response as arguments, Appellant has simply pointed out that Glenn identifies element 20 as a substrate. Furthermore, Glenn, at column 6, lines 30-45 identifies the characteristics of the substrate. Glenn states:

> The substrate 20 that is juxtaposed to the bonding element 18 supports the foregoing elements of the solar cell module 10 and is preferably made of a lightweight, dielectric material. The substrate is lightweight to save launch costs and is a dielectric to prevent electrical shorting. In the embodiment of FIG. 4, the substrate 20 includes a relatively rigid frame 24 that holds a flexible mesh 25. The frame 24 may be constructed of materials such as graphite, while the mesh 25 may be constructed of materials such as glass fiber or a woven fiber like Kevlar.TM. by Dupont. In another embodiment shown in FIGS. 5A-B, the substrate 20 is constructed of a material such as a dielectric film 28 like Kapton.TM. by Dupont, which is adhered to a more rigid substrate, such as graphite or Kevlar.TM. impregnated with epoxy resin.

Appellant has argued that the substrate as described in this paragraph is comprised of materials that are consistent with thermal insulators and not heat sinks. Appellant has argued that a heat sink would be selected from materials having good thermal or heat conductivity and has provided the equation for heat transfer in its Appeal Brief, namely:

$$Q2 == \lambda * A2(T1-T0)/l$$

where Q2 is the amount of heat transfer, l is the length of the heat sink, A2 is the cross-sectional area of the heat sink and λ is the heat conductivity (also known as thermal conductivity) of the material. Conversely, a material with poor thermal conductivity would be selected as a thermal insulator. Thus, one skilled in the art selecting a material for use as a conductor would choose a material having high λ value, while one skilled in the art selecting a material for use as an insulator would choose a material have a low λ value.

The Examiner, in his reply brief, indicates that the Appellant is arguing limitation that are not within the claims as the claims do not require thermal insulators. Appellant is forced to make this argument, as the Examiner is attempting to characterize parts made from material that is used for thermal insulation as a heat sink. The Examiner does not acknowledge the distinction between thermal conductors, or heat sinks, and thermal insulators, as would be apparent to a person having ordinary skill in the art. These distinctions are recognized by a person having ordinary skill in the art and the differences are set forth in definitions, provided by Appellant as Attachment 1 from The McGraw Hill Dictionary of Scientific and Technical Terms (Sixth Edition). The definitions include heat sink, insulator, thermal conductor and thermal conductivity. Appellant notes that The McGraw Hill Dictionary of Scientific and Technical Terms (Sixth Edition) defines a "heat sink" in an electrical application [ELEC], such as the solar cell of the present invention, as a mass of metal added to a device for the purpose of absorbing or dissipating heat. This definition is the context in which heat sink has been used by Appellant. Appellant's arguments are directed to heat sinks (thermal conductors) and has pointed out that the art cited by the Examiner teaches a substrate that is comprised of material that is consistent with a thermal insulator, which accomplishes the opposite effect of the claimed heat sink. Appellant notes that the definition supplied indicates that the heat sink is a mass of metal, and Appellant has consistently argued throughout the prosecution that the art cited by the Examiner as a heat sink is, in fact, comprised of materials that are consistent with thermal insulators, that is, their purpose is not to absorb or dissipate heat.

The Examiner further dismisses Appellant's arguments with regard to exhibits submitted by Appellant in its Brief supporting the low conductivity (λ) of some of the materials described in the Glenn reference, even though these exhibits support what a person having ordinary skill in the art would recognize. The Examiner indicates that while materials such as glass and Kapton have low thermal conductivity, the exhibits do say "nothing about 'unable to transfer heat' or 'cannot function as a heat sink'". The Examiner also points to the fact that Glenn teaches graphite, a material of good heat conductivity. Actually, graphite displays both heat and electrical conductivity that is anisotropic. See Attachment 2 (Lange's Handbook of Chemistry, available on-line at http//genchem.chem.wisc.edu/lab/PTL/ptl/Properties/eleccond.html). In the axial direction, heat (and electrical) conductivity is good, as the Examiner has noted, but in the transverse direction, heat (and electrical) conductivity is poor. The information

provided to support Appellant's position with regard to the thermal conductivity of graphite is well-known and readily available to those skilled in the art, but is provided to the Board as a convenience. The values of the thermal conductivity of carbon (graphite) in the parallel direction (1950 k(W/m-K)) and the transverse direction (5.7 k(W/m-K)) are also provided as Attachment 2 (Source The Physics Hyperbook). As noted, the electrical conductivity of carbon (graphite) is also anisotropic in the same directions as thermal conductivity, as indicated in the attachment calculated from Lange's Handbook of Physics and Lange's Handbook of Chemistry. Since Glenn teaches that his substrate must act as a dielectric (see above paragraph), the electrical conductivity and thermal conductivity must align in the same plane, therefore a person having ordinary skill in the art would appreciate Glenn to teach graphite oriented so that it acts as a dielectric, and therefore, as a thermal insulator in the direction of heat flow. The Examiner does not wish to acknowledge that, depending upon the form, graphite is also a poor conductor of heat. (See attached references)

The arguments presented by the Examiner further indicate the Examiner's refusal to acknowledge that there is a difference between a heat sink and an insulator. Essentially, the Examiner's s argument allows the use of any material to function as a heat sink, with no regard to its thermal conductivity (λ). The Examiner's position is that thermal conductivity (λ) is completely irrelevant. This would appear to be contrary to the thermodynamic principles that Appellant has attempted to set forth in its Appeal Brief and repeated above.

Appellant understands that *KSR International Co. v. Teleflex Inc.*, 127 S.Ct 1727, 82 USPQ2d 1385 (2007) effectively eliminated a rigid application of the TSR test, providing the USPTO more flexibility in examining patent applications. However, *KSR* still requires an examiner to recognize "the effects of demands of the design community ....the background knowledge possessed by a person having ordinary skill in the art." *KSR* at 1396. *KSR* does not go so far as to ignore established scientific principles, such as those presented above regarding heat transfer. Nor does it allow interpretation of the prior art in a manner opposite to what it teaches. Here, the Examiner ignores heat transfer principles, how a person having ordinary skill in the art would select the materials for a heat sink, as well as the teachings of Glenn, which clearly are directed to the use of materials that are not associated with heat sinks to fashion this rejection.

Furthermore, the Examiner does not consider the effect of his proposed substitution on the claimed solar cell structure. Appellant offers the following for consideration. As discussed in the Appeal Brief, a heat sink made from copper, which one skilled in the art would normally select, has a thermal conductivity that is 4000 times greater than Kapton, which is taught by the Glenn reference relied on by the Examiner. Assuming arguendo that the substitution suggested by the Examiner could be made, which Appellant does not admit, if the heat sink claimed in Applicant's specification was made in accordance with practices of persons skilled in the art was 0.1 inches in thickness of copper, then the Kapton material would be required to be 400 inches (33 feet) thick. Appellant submits that this substitution would render the solar cell unusable not only for extraterrestrial applications, but also for terrestrial application.

(b) The Examiner also relies on Hartman as teaching a heat sink. The Examiner identifies item 22 of Hartman ('051 reference) as a heat sink. Hartman states at column 4, lines 15-24 that "it is preferable to employ a non-conductive reinforcing tape 22 to provide reinforcement thereto. Such reinforcing tape is preferably an adhesive backed polymer tape." Thus, not only is the tape non-conductive, but the adhesive is also a non-conductive material. All the arguments applied above to Glenn also apply to the Examiner's mischaracterization of the non-conductive tape of Hartman as a "heat sink". Assuming, arguendo, that the substitution could be made, the characteristics of the disclosed non-conductive reinforcing tape of Hartman would be changed and would no longer be a "tape," but rather a "block," as necessitated by differences in thermal conductivity between non-conductive and conductive materials as discussed in the preceding paragraph.

Issue 2. Does the prior art teach a joint between the intermediate structure and the heat sink, wherein the joint comprises a metallic trace deposited on a dielectric layer?

Dependent claims 9, 14 and 19 each include a limitation to a joint comprising a metallic trace deposited upon a dielectric layer. The Examiner's own rejection recognizes the infirmity of the Glenn reference, which teaches adhering a sheet of metal to a substrate using an intermediate adhering layer, which a person having ordinary skill in the art would not recognize as "depositing upon a dielectric layer". "Depositing" is a term of art used to indicate the application of a material directly to a substrate or base and is used to distinguish the metal trace component from formed metal trace components such as films, sheets, stampings or etched that may be thicker or whose thicknesses are more difficult to control. The McGraw Hill Dictionary of Scientific and Technical Terms, which serves to illustrate what a person having ordinary skill in the art would understand, defines the term "deposit" in material applications [MATER], which is the relevant category, as "**any material** (emphasis added) applied to a base by means of vacuum, electrical, screening or vapor methods." A copy of the definition is provided as an Attachment hereto. Deposition techniques are known to permit precise application of materials in controlled but ultrathin layers. Furthermore, "depositing upon the dielectric layer" does not allow for an intermediate layer between the metallic trace and the dielectric layer, the dielectric layer being the substrate or base. Applicant's specification sets forth one method for <u>depositing</u> material, which is chemical vapor deposition (CVD). The Examiner does not wish to recognize that such deposition techniques as CVD are used to deposit metals, because even though Appellant's specification refers in para. [0027] to depositing both silicon nitride (for a non-conducting layer) and metallic traces, para. [0027] only references the CVD process with respect to the silicon nitride. Appellant submits that this is an overly rigid interpretation of para. [0027], given reference to the McGraw-Hill definition of deposition of depositing. The cited prior art, which may disclose metals, certainly does not disclose deposited metals, as Appellant has argued in its Appeal Brief at page 16. The Examiner's own rejection recognizes that infirmity of the Glenn reference, which teaches adhering a sheet of metal to a substrate, which a person having ordinary skill in the art would not recognize as depositing or deposition.

Appellant submits in response to the Examiner's arguments with regard to the differences between "depositing" and "adhering" that it is not possible for an applicant for patent to anticipate every possible rejection that an examiner may fashion and

explain the differences in advance of a rejection. Here, the applicant clearly described "depositing metal traces" as that term is used in the art.

The Examiner recognizes the infirmity of the cited art and responds that the claims utilize the term "a metal trace deposited upon a dielectric layer," the term "deposited" being deemed to be a product-by-process limitation. Appellant submits that the Examiner is elevating form over substance as the claims could readily be rewritten, by Examiner's amendment, if the Examiner is amenable to allowing the application to read "a deposited metal trace upon a dielectric layer" or "a metal trace deposit upon a dielectric layer," so that the verb "depositing" is removed from the clause. Each of these phrases describes the distinctive structural characteristic of a deposited metal trace applied to the dielectric layer, as discussed above from, for example, an adhered metallic sheet or film joined to a dielectric layer.

Appellant has provided as attachments to this reply brief a number of definitions to support Appellant's position with regard to what a person having ordinary skill in the art would understand. As Appellant has noted above, an applicant cannot anticipate every argument in preparing its specification that an Examiner may utilize in a rejection, but Appellant should be allowed to rely on the meaning of terms as utilized in the art, both for what the specification teaches and for what the prior art teaches. Here, Appellant does not believe the cited prior art teaches either the use of a heat sink or deposited metal traces, as claimed in its claims.

## SUMMARY AND CONCLUSION

Appellant asks that the Board reverse the rejections and indicate the claims as allowable.

The Commissioner is authorized to charge any fees determined to be due to the undersigned's Account No. 50-1059.

Respectfully submitted,

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Attachments:

1. The McGraw Hill Dictionary of Scientific and Technical Terms (Sixth Edition) definitions of "heat sink"; "insulator"; "thermal conductor"; and "thermal insulator".
2. Lange's Handbook of Chemistry, available on-line at http//genchem.chem.wisc.edu/lab/PTL/ptl/Properties/eleccond.html and Values of Thermal Conductivity of Graphite from Physics Hypertextbook available at http//hypertextbook.com/physics/thermal/conduction.
3. The McGraw Hill Dictionary of Scientific and Technical Terms (Sixth Edition) definitions of "deposit".